USGS science for a changing world
Astrogeology Research Program

Solar System Mass Distribution

Grade Level: 6th –12th

Objectives:
- Create a scale model of the sun and the planets
- Understanding of mass distribution of the solar system

Arizona State Standards:
- **1SC-P2.** Compare observations of real world to observations of a constructed model. **PO 1.** Assess the capability of a model to represent a "real-world" scenario.
- **1SC-P1**. Propose solutions to practical and theoretical problems by synthesizing and evaluating information gained from scientific investigations. **PO 1**. Evaluate scientific information for relevance to a given problem

Time needed: 1 class period

Introduction:
99.87 percent of the mass of the solar system is contained in the sun. Most of the remaining mass, 0.13 percent, is contained in the planet Jupiter. The planets revolve around the sun because it has the greatest mass and therefore the greatest gravitational force. In a sense, all the planets are falling toward the sun. This lesson will help students understand the concept of how mass is distributed in the solar system. Students will also get a better understanding of just how much more mass the sun has than the rest of the solar system.

Materials:
- Bags of Playdough or clay (provided)
- Balance
- Wax paper (provided)

Procedure:
- Divide students into groups of 4 or 5.
- Each group will receive a bag of clay or Playdough. Your lab area should have wax paper and a balance.
- Pass out the Student Lab Sheets, one per group.
- Students will immediately start Part I of the lesson.
- After students have completed Part I, direct their attention toward the teacher and give them the following data:
    - The sun contains 99.87% of the mass of the solar system
    - Most of the rest of the mass (0.13%) is in Jupiter
- Have the students complete Part II of the lesson and turn in their work for a grade.

Additional Resources:

- http://seds.lpl.arizona.edu/nineplanets/nineplanets/sol.html
- Clay Planets: http://www.windows.ucar.edu/tour/link=/teacher_resources/clayplanets_edu.html
- http://www.ipfw.edu/educ/e328jn/loumegan/lesson.html
- http://www.vendian.org/mncharity/dir3/solarsystem/

Play dough Recipe:

1 cup flour
½ cup salt
1 Tablespoon oil
2 teaspoons cream of tarter
1 cup water
Food coloring

Mix all ingredients in saucepan. Heat on low, stirring constantly until dough is evenly mixed and forms a ball. Knead slightly. Store in an airtight container or plastic baggie.

Student Lab Sheet – Solar System Mass Distribution

NAMES_____
_____
_____
_____

PART I.

1. Determine the TOTAL MASS of your Playdough. Take it out of the bag and place it on the balance.

   TOTAL MASS OF PLAYDOUGH IN BAG = _____

2. Now remove enough Playdough from the balance to get a mass that is rounded to the nearest whole number. (For example if your total mass is 457.30 grams, remove enough Playdough to make your total mass 450 grams. HINT it is better to use rounded numbers such as 400, 500, 200, etc…)

   ROUNDED MASS = _____

3. Create a model of the Solar System using the remaining Playdough.
4. Find the mass of each planet and fill in blanks below. Your model should include the following:

   SUN = _____ grams

   MERCURY = _____grams

   VENUS = _____grams

   EARTH = _____grams

   MARS = _____grams

   JUPITER = _____grams

   SATURN = _____grams

   URANUS = _____grams

   NEPTUNE = _____grams

   PLUTO = _____grams

5. After you have completed this section, let your instructor know and we will discuss your Solar System models.

PART II.

1. Now that you know how mass is distributed in the Solar System, create a new model of the Solar System TO SCALE. This means, make sure that if the sun is 99.86 % of the mass of the Solar System, that 99.86% of your Playdough is used to make the sun.

   Example: 500 g x 99.86% = 499.3 grams goes into the sun
   500 g x 0.13% = 0.65 grams goes into making Jupiter

2. Determine the new mass of your sun and fill in the spaces below.

   NEW MASS OF SUN = _____grams

   NEW MASS OF JUPITER= _____ grams

   NEW MASS of the rest of the SOLAR SYSTEM = _____ grams

3. Now that you know how the mass in the Solar System is distributed. Answer the following questions.

Where is most of the mass in the SS?

Why don't the planets revolve around Jupiter instead of the Sun?

How did the mass of the SS end up where it is today?